PC Life Cycles

Guidelines for Establishing Life Cycles for Personal Computers

Department of Information Resources
Austin, Texas

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Executive Summary

Purpose

The Department of Information Resources (DIR) has published guidelines for making lease-versus-purchase decisions when acquiring computing resources.[1] This paper, as a companion report, suggests specific strategies that agencies can use to plan for and manage their personal computing resources. Agencies should also use the information in this paper in concert with seat-management principles and acquisition strategies for computing resources.

Establishing a PC life cycle gives Information Resources Managers (IRMs) a tool to control budgets and respond to management with a strong business case, including quantitative justification for benefits to the agency. This paper provides IRMs with the information they need to establish a PC life cycle, so that they can develop a strategy that meets their needs most appropriately. It focuses on three steps: identifying the business needs and developing a case for establishing a PC life cycle, defining agency-specific end user needs, and identifying agency-specific technology considerations.

The extensive range of agency sizes and specific needs should compel each agency to go through the decision process outlined here to determine a life cycle that would provide the most cost-effective strategy. Strategies range from individual PC purchases to seat management licenses (including customer/help desk support) and leasing alternatives based on your organization's life cycle and funding considerations.

Issue

Personal computers (PCs) are now everyday tools for many state employees. Historically, these purchases have been treated as large capital acquisitions, where agencies are expected to see value from the purchase over time. The rate of technology change, however, has led to PCs becoming functionally obsolete after an increasingly short period. Investment in this type of technology is no longer a one-time expense; it is an ongoing operational expense that must be incorporated into yearly budget planning for agencies and universities. For the purpose of this white paper, the term agencies will refer to both agencies and universities.

Budgeting for PC purchases, however, poses a management challenge. This is true not only because PC technology changes faster than most other types of equipment, but also because budgeting cycles are biennial. It is difficult to project the status of technology even a year into the future, much less make the 4-year projections required in a biennial operating plan or legislative appropriation request. Agencies and universities spent between $231 million and $240 million per biennium on PC hardware since the 1996–97

1 State of Texas, "Guidelines for Lease vs. Purchase of Information Technologies," Department of Information Resources, May 1998. Available online at *About the Lease vs. Purchase Guidelines,* Web page, accessed 18-Mar-2003 at <http://www.dir.state.tx.us/oversight/lvp/index.htm>.

biennium.[2] At the same time, the Statewide Property Accounting (SPA) division of the Comptroller of Public Accounts has determined that state PCs average 6 years in age at their disposal stage; subsequently, 72 months is the default SPA depreciation cycle if an agency does not establish a life cycle for both its desktop and laptop PCs.[3]

Many state agencies need to adopt policies and procedures to keep their PC costs under control. But how can they accomplish this given the rapid pace of technological change? This paper explains how to determine effective life cycles for PCs based upon organizational needs.

There are also numerous other states who have adopted PC life cycles. A few examples are:

- *Iowa* – Enterprise IT Standards Program (Standard S-TA-001-001) sets the minimum mainstream personal computer life cycle at 4 years, 3 years for high-end power users.[4]
- *Nevada* – PC Upgrade and Replacement Schedule states that mainstream technology users' replacement life cycle is 4 years, while the conservative technology user's PC life cycle is 5 to 6 years.[5]
- *Montana* – Identifies a minimum 4-year replacement life cycle for PCs where support is structured around the 4-year replacement cycle. The highest level of support is provided for software and hardware less than 4 years old.[6]

There has been a definite trend to move to longer PC life cycles in the last year, largely due to budgetary constraints, but also due to stabilization of the software operating systems and application platforms being released.

PC life cycles must be established before determining what acquisition strategy an agency will use to procure the equipment. The state is beginning to incorporate seat management as an acquisition alternative for PC hardware. Seat management is a means of outsourcing the acquisition of desktop hardware and software, potentially including desktop support as well, to provide an outsourced solution for the desktop environment. Although it is important to mention seat management when considering today's PC environment, this paper will not address seat management as an acquisition alternative.

Texas has statewide contracts available through DIR that allow agencies to select their hardware and software solutions from entities that specialize in desktop/laptop technology and support. DIR negotiates the "best value" rates for these products and services to ensure consistent cost effectiveness.

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2 Texas state agency and university Biennial Operating Plans for Information Resources Management, Fiscal 1998–99.

3 State of Texas, "Statewide Property Accounting Manual," Comptroller of Public Accounts. Available online at *Controlled Class Codes,* Web page, accessed 1-Apr-2003 at <http://www.window.state.tx.us/comptrol/san/spa/controlclasscodes.html>.

4 State of Iowa, "Personal Computer Hardware Platform: Desktop," Enterprise IT Standards Program, Information Technology Department, Policy & Planning Division, December 21, 2001. Retrieved 3-Mar-2003 from <http://www.state.ia.us/government/its/ITStandards/enterprise_it/1platform_hard.html>.

5 State of Nevada, "Personal Computer Equipment Replacement and Upgrade Schedule," Department of Information Technology Policies, Standards, and Procedures, Executive Branch. Revised February 21, 2002. Retrieved 3-Mar-2003 from <http://psp.state.nv.us/Documents/CH2.5.1.1.htm>.

6 State of Montana, "PC Replacement Cycle," Information Technology Enterprise, Policy ENT-PCS-010, September 15, 1998. Retrieved 3-Mar-2003 from <http://www.discoveringmontana.com/itsd/policy/policies/entpcs010.asp>. Also see Appendix F.

The industry standard for PC life cycles is often used as a "rule of thumb" to justify purchases of desktop and laptop computers. The current industry standard for a desktop computer is 4 to 5 years, while that of a laptop computer is 2 to 3 years.[7] After these periods, technology has changed so much that the equipment is functionally obsolete. It is reasonable to move toward the longer ranges of the replacement cycles; however, there are several risks that will be discussed in the paper associated with this extended life cycle. Appendix F contains examples of potential expenses and risks related to extended PC life cycle policies.

The industry standard is not a valid measure, however, unless there is agency-specific data that supports the life cycle time frame. The following steps can be used to develop an appropriate life cycle:

1. *Identify Management Principles* – Review executive management's needs and priorities for the organization and technology support. Identify the criteria for evaluating the success of instituting a PC life cycle.

   Why? Understanding current processes and identifying where problems exist enables an agency to find a solution that shows direct, quantified benefits from instituting a formal life cycle policy.

2. *Evaluate Agency Needs* – Conduct a needs assessment of end-user computing needs, both current and future. High-end end users such as engineers, financial analysts, scientists, and network specialists, will require a shorter life cycle to support the applications and technology configurations required for these functions.

   Why? PC replacement cycles should not be based solely on technology development cycles. A life cycle should be established that is based upon the actual needs of the users.

3. *Evaluate Technical Factors* – Review information on existing technology product offerings to determine which technology is most appropriate for end users and most cost effective for the agency. Compare actual technology needs to the technology that would be acquired if the industry standard were used. Establish the technical design and functionality of the PC configurations that the organization chooses to support.

   Why? The industry standard is often used to support PC acquisition. An assessment of the state of technology allows an agency to map actual needs to the available technology, and to plan for acquiring new technology at its most cost-effective point. It is important to note that the organization should always be in control of its PC configuration management since this configuration and life cycle will ultimately determine the agency's ability to meet its goals through the use of automation at the desktop.

The information gathered at each of the above steps is used to determine the life cycle. Agencies will match user needs to the available technology, weighing in factors such as agency priorities and technology developments.

7 Margevicius, Mark, "Desktop PC Life: Four Years for the Mainstream," Research Note T-13-8045, Gartner Group, August 21, 2001.

Bottom Line

There are no absolute life cycle numbers. The industry standard life cycles may not be a good fit for all state agencies. A formal process to identify weaknesses in PC management procedures, develop user profiles for equipment, and consider technological advances must take place to develop a PC life cycle best suited to the needs of a particular agency. PC acquisition will require ongoing expenditures, but establishing a needs-based plan for managing the expenditures will assist in stabilizing PC costs. Agency enterprise strategies should include plans for PC upgrades and replacements based on end-of-cycle issues rather than new or emerging (bleeding-edge) technologies.

Introduction

PC Life Cycles

Personal computers are the primary productivity tool used by most state agency personnel. PCs constitute one of an agency's most volatile, prolific, and mandatory expenditures. While some agencies may have only a few employees, other agencies may employ thousands. Similarly, some agencies utilize more PCs than others, depending on how essential these tools are for delivering agency services. In an effort to address these issues and concerns, Texas has identified what a reasonable PC life cycle is. *A PC life cycle describes the usefulness of a desktop or laptop computer to the agency, from its initial acquisition through its ultimate disposal.* A life cycle is determined based on end-user needs, technology changes, and the cost to support technology. The current industry standard for a desktop computer is 4 to 5 years, while that of a laptop computer is 2 to 3 years.[8]

Organizations should draw a distinction between PC life cycles for systems already purchased versus future purchases. This is especially true for PCs purchased prior to the year 2000. Many PC configurations prior to this period cannot support the current versions of Microsoft operating systems. As a result, agencies are finding a need to upgrade these machines, despite the 3-year life cycle they have incurred, to implement current operating systems and computer applications.

Agencies are responding to sharp budget cutbacks expected in the 2003/2004 biennium causing many organizations are stretching their desktop life cycles. Gartner estimates that by 2004, 85% of users will adopt a 4-year desktop life cycle. Whether organizations and consumers can live with a longer life cycle depends on how many end users within an organization would benefit from the capabilities of an updated PC, operating system, and application versions.

Regardless of how long the PC life cycle is, an organization should avoid fragmenting its user base among different operating systems and application versions. The more variations in the PC image that the IT organization must support, the more complex and expensive that support becomes.

PC Life Cycle Ranges for State Government	
Laptop Computer Life Cycle: 2 to 3 Years	Desktop Computer Life Cycle: 4 to 5 Years

The 4- to 5-year life cycle for desktop computers is viable only when little to no change is occurring in an agency's hardware and software environment. In addition, agencies must

8 Adapted from the following:

Friedlander, David, et.al., "Longer Desktop Refresh Cycles Require Review of Desktop Management Processes," Ideabyte RIB-112002-00137, Giga Information Group, November 22, 2002.

Kleynhans, Steve, et.al., "Client Systems Will Require More Processing Power," News Analysis, File 0341, META Group, December 20, 2001.

also have extended service contracts for support of operating systems or agencies must be able to provide in-house support staff that can provide support for the extended period that operating systems are in use. Appendix F contains examples of potential expenses and risks related to extended PC life cycle policies.

The primary customer for whom the extended cycle is best suited is the low-end mainstream user of standard software packages. The extended life cycle is not without risks. Operating system (OS) software for PCs is generally replaced in the industry every 3 years. As a result, an agency with an extended desktop cycle may have to provide internal support for non-vendor supported software for as long as 18 months before the hardware/software platform is refreshed. Research indicated that although utilizing unsupported software is a risk, it is a reasonable expectation based on industry trends to run a proven operating system for 4 to 4.5 years without severely increasing risks of operating system failure.

The life cycle for laptops should remain within the range of 2 to 3 years. Usage dynamics such as the mobility of laptops reduce their durability. Industry research indicates that expected failure rates of 20% could be expected for laptops due to mobility damage alone.[9]

The maximum ranges of the PC life cycles expose the agency's equipment to the risk of vendor failure and market uncertainty. The agency must exercise due diligence in evaluating the vendor before establishing the longer cycles as standard and before contracting for long-term service and support for the life of the equipment.[10] Refer to Appendices E and F for sample comparisons of a shorter-versus-longer life cycle.

Software and Support Considerations

Industry trends are not only moving toward more software applications being delivered to the PC environment from a server-base or browser-base, but also being deployed as an image for each client station. In other words, many organizations identify standard end-user profiles for their high- and low-end users, or perhaps use a profile based on user functionality. Then, when a user desktop is configured, a standard image (a predefined package of software applications and capabilities such as access to certain files and servers) is pushed out to the desktop. This administrative tool using LAN management and end-user profiles to push software applications to the desktop also plays an important role in hardware cycles. These management techniques and tools allow agencies to extend their PC life cycles due to standardization and less frequent operating system revisions. Additionally, this standardization and central management reduces support staff service costs due to commonality of computer infrastructure.

PC hardware must be planned to support the operating system and software applications that the agency selects as its standard. Software installation requires hardware with certain capacity and performance capabilities. Thus, some consideration must be given to the organization's software structure while determining the initial hardware configuration and the hardware life cycle.

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9 See footnote 7 (Margevicius).

10 Schlegel, Kurt, "Radical Desktop Changes Can Assuage IT Budgets," Web & Collaboration Strategies, File 1061, META Group, November 16, 2001. Reprinted with permission in Appendix E.

Customer support services must also be considered. For example, if the hardware life cycle is determined to be 4 to 5 years and the industry trends indicate that software operating systems are revised or replaced every 3 years, then an extended software support agreement must be considered for the remaining years of service that the operating system is expected to function beyond its normal life cycle. Internal agency support can also be utilized to span the later years of support for the operating system. Microsoft has recently shifted to a 5-year and 2-year support cycle (5 years from release to manufacturing for primary support and 2 years for reduced support). This reinforces that the life cycle can be shifted outwards to 5 years for desktops.[11]

Did You Know?

- Falling computer prices and commodity markets will not reduce the total cost of computing.
- Cheap PCs with the power of mainframes are not making distributed computing cheaper than central computing.
- Information technology investments cannot be effectively managed through an ad hoc funding process.
- PCs and distributed computing environments do not mean an end to central computing authority and enterprise-wide standards.
- Labor costs far exceed the initial acquisition costs of computing equipment.
- The deciding criterion for investing in technology is not cost, it is cost/benefit.

— Cause / Effect [12]

Life Cycle Management

PC life cycles reflect the entire cost of owning a desktop or laptop computer, from decisions and negotiations regarding purchases through management (including maintenance) of the resources and disposal of obsolete equipment. The life cycle quantifies costs beyond the purchase price of hardware and software. The determination of how long a PC is useful and cost effective to an organization must be made with a complete understanding of overall processes and agency needs. Establishing PC life cycles should be part of the technology planning process.

Life cycle management planning should involve a multifunctional team effort facilitated by the agency's Information Resources Manager. The goal of this team is to recommend enterprise-wide requirements and acquisition alternatives for the agency. In addition to the IRM, the team should include end users, decision-makers, and representatives from key business units, including audit/asset management, purchasing, customer support, and IT staff.[13]

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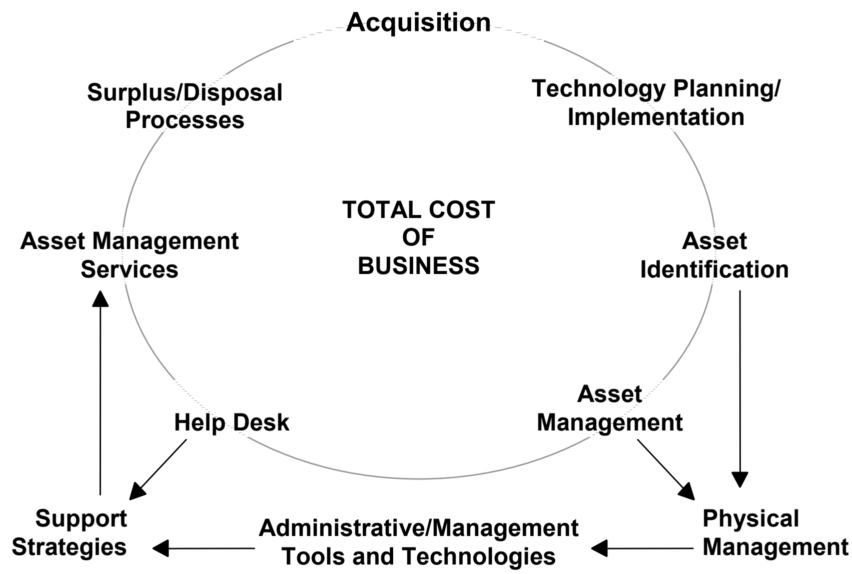
11 Enderle, Rob, "IT Trends 2003: Desktop Technology," Planning Assumption RPA-112002-00005, Giga Information Group, November 6, 2002.

12 Oberlin, John L., "The Financial Mythology of Information Technology: Developing a New Game Plan," Cause/Effect, Vol. 19, No. 2, Summer 1996. Retrieved 28-Feb-2003 from <http://www.educause.edu/ir/library/html/cem9624.html>.

13 See footnote 7 (Margevicius).

Life Cycle Stages

The various stages of a PC life cycle, shown below, are based on a timeline determined by a combination of user needs and technical issues.



The Decision Process

Process Overview

The following steps outline the decision process that agencies can use to establish an effective life cycle. Caution should be given not to simply adopt the industry standard. Each organization should evaluate its resources and plan for a life cycle that supports its agency goals. The life cycle establishment process will quantify ways in which information resources can be managed cost-effectively, while still remaining responsive to the needs of the agency.

Step 1: Identify Management Principles

A. Define and obtain executive support for technology management
B. Define expected results from establishing a life cycle
C. Identify benefits to justify costs
D. Prioritize the effort in light of overall mission, goals, and strategies

Step 2: Evaluate Agency Needs

A. Assess current processes for technology support and maintenance
B. Assess the availability of technology support staff
C. Assess the needs of end users

Step 3: Evaluate Technology Factors

A. Understand the rate of technology change
B. Assess strategies and technology to provide adequate technology resources
C. Incorporate technology into the life cycle

Establish a PC life cycle based on the results of steps 1, 2, and 3, above

Step 1: Identify Management Principles

To begin the life cycle development process, an agency should identify some basic principles that define the role of the IRM in this process, establish a framework to evaluate the results of the effort, and consider the overall importance of technology to delivering agency services to citizens.

A. Define and Obtain Executive Support

Executive and other senior management must support the PC acquisition policies and/or life cycles that are developed. The development of policy for desktop and laptop technology acquisition should be centralized under the authority of the IRM. Decentralized decisions about PC purchases can lead to the proliferation of multiple platforms and models that the agency must support. If separate divisions can order PCs without involving the technology staff tasked with supporting the equipment, it will not be possible to develop an effective life cycle policy or process. The technology support group needs, at a minimum, either the responsibility for ordering, repairing, and replacing PCs, or the authority to set standards for PC life cycles and standard configurations.

B. Define Expected Results

Benefits such as cost effectiveness or cost savings need to be identified. The up-front definition of benefits will also help to justify the costs of the effort. Benefits will not be apparent, however, unless they are defined from the beginning. The definition of expectations is also crucial for obtaining management support.

Like improved customer service, it is difficult to quantify the impact of investments in PC technologies because these benefits affect the entire organization, not just one or two functions or activities within it. In the same way that the telephone is a necessary resource for almost every employee, desktop computers are essential to the day-to-day work of most state agency employees. However, one difference between them is that telephone technology does not change as rapidly and therefore does not have to be replaced and upgraded as often as desktop computers do.

Successfully establishing a life cycle requires that expectations be set at the beginning regarding the results of adopting a life cycle. Life cycle planning needs to answer the question of how the agency will benefit from establishing the controls required by a life cycle.

C. Identify Benefits

Developing PC life cycles gives agencies the chance to assess their current processes and identify potential areas of improvement. To set a life cycle for commodity equipment such as desktop and laptop computers, a preliminary step is to understand the current situation, so areas where improvement is most needed can be base lined and quantified. This justification is important to acquiring management support. Life cycles can provide benefits such as:

- Improved management of hardware assets through better knowledge of and control over the PC inventory

- Cost savings from standardizing equipment and controlling when, what, and how PCs are purchased
- Reductions in technical support costs for PC troubleshooting and maintenance

To assess the dollar value of these benefits, agencies should know how much they are spending for PC acquisition, as well as how much they are spending to support these assets. Appendix A provides a list of potential criteria for assessing benefits. Current policies should be reviewed to see where the organization could benefit from strengthening control over its PC acquisition. The Information Resources Management Act states that all agencies must perform a biennial software audit.[14]

Understanding the customer support and capacity requirements for all software combined with awareness of the existing hardware platforms across the organization will enable the information technology (IT) staff to ensure adequate PC life cycles to provide lasting and cost-effective equipment management. Establishing PC life cycles is a first step in asset management that allows equipment to be fully utilized by an agency before it is replaced. However, there should always be provisions for replacement of faulty or defective equipment during the life cycle.

D. Prioritize the Effort

The overall needs of the agency are an important factor in the benefits identification process. Before determining that the most cost-effective way to support staff is to buy new PCs every 4 to 5 years, evaluate the cost of that life cycle against the agency budget and overall priorities. The cost effectiveness of the life cycle is important, but a critical part of evaluating cost effectiveness is how much it allows you to support direct accomplishment of the agency's goals. Technology supports an agency's mission, and management policies must reflect that role.[15]

Business Impact

CIOs are demanding IT budget cuts. Rash decisions that constrict desktop flexibility will impinge on end-user productivity and business will ultimately suffer.

— META Group [16]

Decisions on funding the establishment of a PC life cycle should be taken into consideration with other agency priorities, such as replacing aging vehicles for staff travel or adding an additional publication or resource. The technology decision never takes place in a vacuum, so funding for a PC life cycle must be cost effective and/or must show how establishing a life cycle will improve an agency's ability to conduct its business. One positive result of establishing a PC life cycle is the ability to level budgets by allocating costs to replace approximately 20% to 25% of the PCs each fiscal year. Further advantages can be realized through seat management alternatives, which can be used to standardize the agency infrastructure, customer support/help desk functions, and replacement/refresh

14 TEXAS GOV'T CODE ANN § 2054.124 (Vernon 2002).

15 See footnote 10 (Schlegel) or Appendix E.

16 Ibid.

cycles. There are numerous seat-management contracts, with multiple platforms and vendors, available through DIR's online Product and Services Catalog.[17]

Step 2: Evaluate Agency Needs

An understanding of agency end-user needs and support staff resources will directly impact the life cycle. A life cycle requires knowing how to gauge whether or not technology is meeting existing agency needs within current budgetary constraints. This requires an assessment of whether or not current computing resources meet the defined productivity requirements of the agency, division, department, or workgroup under examination. For example, imagine that a newer PC performs certain processing tasks faster and more efficiently than those currently used by a specific department. Also, assume that adopting this new technology would dramatically reduce the time that personnel currently spend on tasks using the current equipment. In this scenario, a PC might be replaced simply because the economic benefits gained through staff time and cost savings outweigh the expense of replacing the existing equipment.

> Traditional wisdom governing technology investment decisions views the investment decision primarily as an expense issue. In reality, it is a cost-benefit issue, where the investment is in the goals of the institution as well as the individuals charged with advancing them.
>
> — *Cause / Effect* [18]

A. Assess Current Processes

Explicit strategies should be adopted that enable agencies to assess when it is the right time to upgrade or replace personal computing equipment, whether bought or leased. The most effective replacement or upgrade decisions are driven by whether or not existing equipment meets existing productivity standards.

- The assessment of the current environment gives a starting point for identifying weaknesses in the current PC management processes, and shows where quick modifications can bring significant changes in costs for supporting distributed computing. Existing policies, procedures, and management responsibilities should be reviewed first, to determine if there are procedural barriers to establishing an effective life cycle. Questions for assessing these managerial issues are provided in Appendix B.
- Beyond managerial procedures, however, are other concerns such as technology acquisition and management, staffing, and end user concerns. For example: Standardization of software applications and hardware configurations across the organization should enable maximum cost effectiveness and increase organizational information sharing. IT staff time is reduced for customer support since a common infrastructure is used and diagnosis of problems is simpler.

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17 State of Texas, DIR Products and Services Catalog, Department of Information Resources, Web page, accessed 7-Mar-2002 at <http://www.dir.state.tx.us/store/index.htm>. See "IT Services/Seat Management."

18 See footnote 12 (Oberlin).

The types of questions to ask for these concerns include the following:

- Does the agency have an explicit or an implicit PC life cycle strategy? Is there a written replacement timeline, or is it clear that all PCs will be replaced in a certain number of years, or do some remain in place while newer machines are replaced?
- Are there controls in place to monitor the number and types of PCs? Are there opportunities to save costs through standardizing on one vendor, or on a more limited number of brands and configurations?
- Are current providers evaluated for long-term viability?
- Is the current PC replacement budget adequate for the needs of end users, current systems, and future or anticipated expansions?
- What policies are in place for PC procurement, migration, upgrades, and disposal?
- What are the organization considerations regarding both hardware and software support? Do standardizing software applications and hardware platforms provide the organization better customer support and thus higher productivity?
- Are there formal policies in place for cascading equipment, replacement timelines, etc.?
- How much does the agency spend per fiscal year on PC replacement? (This answer will help justify replacements by allowing the agency to level expenditures across years.)
- Does the IT department have approval authority for technology acquisitions for all areas of the organization? (This is recommended to ensure organizational compatibility and direction.)
- Does the IT department utilize the DIR state negotiated hardware and software contracts to take advantage of best value pricing?
- Do cost estimates also include the costs of maintaining the computer equipment, training required, and time lost when repairs need to be made?
- Is customer support included in the current PC cycle costs?
- Are PCs funded as an asset or an ongoing operating expense? Are they leased or purchased?
- Can seat management be considered as a potential alternative? Is seat management a factor in the PC replacement/refresh strategy?
- How are older desktop and laptop computers reused?
- What processes have moved from manual efforts to automated systems? (This will often trigger an increased need for PCs and associated software configurations to support the agency's daily workload.)

Answering these questions may depend on a basic knowledge of the current PC inventory at the agency. The number of PCs on hand and the type of technology features they contain can illustrate the types of controls present prior to the life cycle establishment exercise. Appendix C provides a checklist for assessing your current equipment.

B. Assess Information Technology Staff

In today's technology environment, Texas agencies are facing critical IT staff shortages. The Year 2000 brought a significant turnover rate to the state in terms of IT staff. There were higher salaries and benefits offered by private industry during this period than what the state could offer. Although there are periodic fluctuations in the market's availability of experienced IT workers, there is a consistent shortage of available staff allocations to IT within state organizations. This is due in part to agency full time equivalency (FTE) caps set by the legislature. Since the legislature determines the maximum staffing limits by agency, it is critical that staff resources be carefully weighed to identify an adequate IT-staff–to–program-area-staff ratio. This can be a difficult decision since agencies are continually expected to "do more with less." PC life cycles, including replacement and upgrade factors, are dependent upon the resources available at each agency. Staff factors include:

- What are the critical projects that staff work on, and how much time is allocated to desktop and laptop support?
- Are any staff members devoted to end-user support? Based on the technology needs of the agency and the skills of the staff, is this the best and most cost-effective use of their time?
- Do staff who provide end-user support leave quickly for jobs that provide more challenges and opportunities for skill development? Industry articles have discussed the importance of an interesting and productive job environment as a critical factor in being able to retain staff.
- Is adequate training available to increase the knowledge base of less experienced staff and end users?
- Is seat management an alternative for providing desktop support to the entire user base, allowing reallocation of experienced IT staff to other IT functions and duties?

These are trade-off factors to consider in the management of desktop and laptop computers. The staff effort to maintain distributed computing environments is considerable, and an assessment of the cost of support against the cost of replacement is necessary.

Organizations moving to longer replacement cycles and fail to adapt their desktop management practices accordingly will see overall PC support and management costs increase by 20% to 30% in years 4 and 5. The following steps should be taken to reduce the management costs of a longer life cycle:

1. Review the existing asset tracking policies to determine if accurate configuration and historical change information is being collected. Emphasis should be placed on

utilizing asset discovery tools to automate the identification of hardware and software assets as well as contract and license compliance monitoring.

2. Evaluate the policies for new equipment requests. Requests outside the established life cycle should be reviewed to determine if any existing equipment is available to be reassigned.

3. Move applications off the desktop if acceptable alternatives exist to store and deploy applications from a server environment. Server-centric and Web-based applications require fewer desktop resources thus extending the desktop life cycle.[19]

C. Assess the Needs of End Users

Once management processes have been determined, it is essential to gain a detailed understanding of the computing needs of end users. This is when an inventory assessment of existing equipment and end-user needs becomes useful. Such an assessment identifies user groups and the types of PCs they use. This information can later be used to build estimated timelines and user profiles for upgrading or replacing existing equipment. A procedure for assessing the needs of end users is provided in Appendix D.

This assessment requires an agency to identify specific user profiles and their computing needs. It bases the acquisition of new resources on actual needs, rather than on individual tastes and the piecemeal acquisition of technology based on funding availability. The basic processes in end-user assessment are to:

- Identify functional types of end users based on job activities rather than on organizational or hierarchical assignments. Balance broad, all-inclusive categories against narrow categories that provide special needs for each employee. Broader categories provide greater standardization and can be easier to manage, but can be too broad to fit some employee needs. Narrow categories allow for employee specialization, but can be reduce the benefit of a life cycle by requiring too many types of hardware and software. Often, three ranges of end users are identified: high-capacity/multifunctional, mid-capacity/multifunctional, and low-capacity/single-function users. PC configurations for all user types can be standardized within a single organization's plan.

- Define the hardware and software needs of each user profile group. Identifying the number and type of applications will help to determine what platform is needed to support their activities.

IT staff can take a proactive role in end-user assessment, as those personnel are aware of the software and hardware needs of end users. Through their efforts in supporting end users, IT staff can identify end users who are candidates for equipment upgrades based on their computing needs.

Software audits should be required and include the evaluation of the end-user desktop/laptop environment to ensure compliance with software license requirements as well as determining continued usage of all software applications installed. Release of

19 See footnote 8 (Friedlander).

software licenses or increase in end-user applications may change the refresh strategy for some users. Current user profiles are critical to cost-effective asset management.

This continual assessment process is essential to a life cycle determination. It is used to determine what types of end users are present in an organization, what their general needs are, what applications they use on a daily basis, their mobility, and how intensively they use desktop and laptop computers. It is not possible to determine what types of hardware should be acquired (including when and how) unless end-user needs are understood.

Step 3: Evaluate Technology Factors

When all of the necessary preparation is complete, the next step is to look at the technology available on the market, understand how product cycles and technology change produce new equipment on a constant and frequent basis, and assess strategies for obtaining and deploying the equipment.

A. Understand the Rate of Technology Change

Computer industry experts estimate the life cycle of a desktop PC to up to 5 years and the life cycle of a laptop computer to be even shorter (2 to 3 years).[20] These figures are based on the PC manufacturers' product life cycle. PC manufacturers anticipate the following timetable when they release a new product into the marketplace.[21]

1. *Basic Research Phase* – A company invents a product and advances it to the point where actual product development can take place.
2. *Research and Development (R&D) Phase* – The company develops and tests the technology product.
3. *Introductory Phase* – The company makes the technology product available in the marketplace and ships the product in high volumes to retailers and/or wholesalers. Customers are educated to accept the product.
4. *High-Viability Phase* – Customers adopt the product and incorporate it into their work processes (often developing a dependency on the product). Shipping and ordering volumes typically indicate the product's viability in the marketplace.
5. *Maturity Phase/Product Phase-Out* – The product begins to mature, the market stabilizes, and the vendor begins to introduce product updates and replacements.
6. *End-of-Life Phase* – New technologies with functional, cost, or performance advantages begin to supersede the product. The vendor eventually stops manufacturing the

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20 Adapted from the following:

Martorelli, William, "CQA: What are Recommended Lease Terms for Desktop and Mobile Computers?" Giga Information Group, September 11, 1997.

Schlegel, Kurt, "PC Leasing Conundrum," Web & Collaboration Strategies, File 1-44; META Group, October 4, 2001.

21 Adapted from the following:

"Technology Product Life Cycle," Section 1.0, Myxa Corporation, 2001. Retrieved 3-Mar-2003 from <http://www.myxa.com/wp_tplc.htm>.

Wyzalek, John, editor, *Handbook of Enterprise Operations Management,* pp. 61, 1999 ed. Boca Raton, Fl: Auerbach, 1998.

product, but still supports it. At the end of this phase, the vendor stops supporting the product altogether.

These stages drive the introduction of new technology in the marketplace. To use the vendor life cycle appropriately, agencies must determine how it fits with internal needs and understand when to acquire new technology.

The Introductory Phase is often one of high risk, adopted by organizations at the "bleeding edge" of technology use. Prices for the equipment are higher in this phase, and are driven down usually within 6 months by newer technologies. Acquiring new technology should be made at later product stages. Equipment purchased during the End-of-Life Phase may be very affordable, but agencies must determine how long the technology will meet end-user needs and how long product support will be available from the vendor/manufacturer.

Tips for working with the product life cycle include:

- Don't buy during the Introductory Phase. Products in this phase are more expensive and may introduce more risks due to the use of emerging technologies or standards. This is especially true for PC operating systems.
- Try to acquire at the early stages of a product's High-Viability Phase (during the upswing in customer adoption), and shortly after the Introductory Phase. This way, the agency is certain to enjoy a longer period of product support. Factors that determine whether a product is in the High-Viability Phase include:
    1. The number of customers using the product in the production setting on a regular basis (more is better);
    2. The number of bugs that are reported (fewer is better); and
    3. The speed at which bugs are fixed by the product manufacturer (faster is better).[22]
- Consider software upgrades in the process. Software developers will design products to work on the latest technologies, and can begin to phase out support for earlier versions. It may be necessary to upgrade hardware in order to run up-to-date versions of common business software applications.
- Computer technology is changing rapidly. The very latest technology carries a hefty premium over similar, but older, technologies. Agencies should consider the job that will be performed with the new equipment, rather than worrying about whether the new equipment will be compatible with some future, unknown task.
- Consider new technologies that are likely to impact hardware configurations such as 3D visualization tools, wireless technology requirements, security applications, e-learning applications, etc.[23]

22 See footnote 21 ("Technology Product Life Cycle").

23 See footnote 8 (Kleynhans).

- Consider acquisition alternatives such as seat management or desktop management that make the most of the valuable financial and personnel resources available to you.

B. Assess Strategies to Provide Adequate Technology Resources

An initial consideration to obtain equipment is evaluating the new and existing technologies. After evaluating the rate of technology change and determining where in the cycle is best for your agency to acquire equipment, the next step is to look at the following factors: product type and class; stability, performance, and value; and strategies to acquire the product and deploy it

1. Product Type and Class

By definition, PCs are not designed for longevity. This is because desktop and laptop computing technologies are small in size and they adapt more readily to technological innovation than do larger mini- or mainframe computers. For information technology products such as PCs, product type and product class affects life expectancy. Product type refers to the difference between hardware and software products, whereas product class has to do with whether the hardware or software is considered high- or low-end technology. The bottom line is that, when determining product life cycles, agencies need to consider not only hardware, but also software life expectancies, because hardware and software usually go hand-in-hand.

The diagram below illustrates the shorter support timeframe for low-end desktop technology.

PRODUCT TYPE
(hardware and software are usually bundled together)

		Hardware	Software
PRODUCT CLASS (determines vendor support timeframe)	**High-end Technology** (longer support timeframe)	Very high performance computers (mainframe, mini, or high-end PC workstations such as Unix systems)	• Operating systems: upgraded every 18 to 36 months. • High-end application software: upgraded every 12 to 24 months, e.g., database management systems (DBMS) • Fast changing software: upgraded very frequently, e.g., security systems, virus scanning,
	Low-end Technology (less critical; shorter support timeframe)	Desktop technology: PCs and laptops	Word processing and spreadsheet software (new products or improved versions are released every 6 months)

Adapted from "Myxa White Paper: Technology Product Life Cycle"

2. Stability, Performance, and Value

Within the low-end technology category, PC vendors also distinguish among different *product lines,* which have their own unique life cycles. The following table illustrates how desktop technology vendors usually position their products in the marketplace following stability, performance, or value criteria.

	PRODUCT CHARACTERISTICS		
	Stability	**Performance**	**Value**
Targeted End Users	Enterprise customers (those in large organizations who need PC access over a long duration)	Customers needing fast access to the latest products	Customers with smaller budgets
Advantages	•Better quality control checks and component checking •Higher support levels •Longer warranties •Better quality and reliability	Leading edge technology, newest capabilities and increased functionality	Less expensive (lowest cost option)
Disadvantages	Lag in getting the latest technology	•Degree of reliability lower •Service/support not as extensive •Product volatility •More expensive	Vendors beginning to focus not on cost, but on value

Adapted from Datapro's "Choosing the Right PCs"

3. Strategies for Product Acquisition and Deployment

> Most organizations are looking to trim costs from the PC slice of the asset portfolio. These trends increase the pressure for IT managers to carefully manage PC assets throughout the client life cycle including: pricing, vendor negotiation, lease-versus-buy, disposal and refresh strategies.
>
> *— META Group* [24]

Acquisition involves not only evaluating the new and existing technologies but also the procurement methods that may be utilized to obtain the product. Deployment of the hardware into the agency environment is also critical to the success of utilizing technology in the work place. Procurement is often an obvious part of the decision process, however, deployment of the hardware to the actual desktop of an end-user can easily be overlooked until well after all the hardware decisions have been made. This may be a major impact to the practicality of both the budget and the technology selection. If users have not been trained prior to the arrival of their new equipment, they may become unproductive for a time until training is made available or until they have acquired self-taught skills. Deployment is a critical aspect of the decision process to ensure a smooth transition of any technology into the daily work environment of the users.

24 Schlegel, Kurt, "PC Portfolio Management," Web & Collaboration Strategies, File 1081, META Group, January 25, 2002.

Acquisition strategies are discussed in greater detail in the next chapter of this document and also in DIR's white paper on leasing versus purchasing.[25] It is mentioned in this section to be sure it is considered during the decision making process.

Additionally, consideration should be given to the recent trend toward seat management. Seat management is defined in this perspective to include not only the acquisition of the PC or laptop hardware but also the standardization of agency platforms, software, and PC configurations for a range of users from high-end users to low-end or specialized user functions. Seat management also includes user training as specified by the agency and help desk support which are otherwise hidden costs of PC management. Several important steps are discussed below outlining factors important in determining which adequate technologies to use plus how to acquire and deploy them.

a. Life Expectancy of Desktop and Laptop Computers

Desktop and laptop technologies have a shorter life span than mainframes, minis, or high-end computer workstations, due to the rate of technology change and product competition. Laptops are also affected by additional factors of wear and tear due to their travel and mobile usage. Desktop and laptop computers contain a myriad of component parts and the speed at which these different parts change determines how long the entire composite piece of equipment is technologically useful.

- *Central Processing Unit (CPU) Considerations*

  Increasingly faster processors power PCs, so upgrades can make the computer operate faster and more efficiently. The CPU is the most important technology component and the item that is replaced most often in the market. New processors are introduced into the market constantly, with computing power expanding exponentially. The 486-chip set that was top of the line in the early 1990s offered a top clock speed of 50MHz. The 2000 Pentium III offers a minimum clock speed of 500MHz and today's Pentium IV and higher technology offers clock speeds at 1.9 GHz to 2.25 GHz.-Clock speed is defined as the fixed vibrations generated from a quartz crystal to deliver a steady stream of impulses to the CPU. In other words, it is a direct relationship to performance. The higher the clock speed the faster the performance and processing power of the CPU. When a new processor is introduced, PC manufacturers quickly incorporate the chip into new models. The applications running on these machines, however, do not necessarily take full advantage of the processing speed available on the hardware. PC and laptop life cycles should not be based on the introduction of new processor speeds, but rather on actual agency needs.

25 See footnote 1 (State of Texas).

- *Equipment Considerations*
  - *Bus Speed* – The CPU is housed on the computer's motherboard along with various circuits that allow communication to take place between the CPU and the other components within the computer setup; for example, input devices such as the keyboard, or output devices such as the hard drive, monitor, and printer. Therefore, the speed of the circuit (the bus speed) is also a key consideration.
  - *Random Access Memory (RAM)* – When there isn't enough RAM in the computer for software programs to use, the CPU has to store data on the hard drive instead of in the RAM area. This space limitation necessitates more communication between the CPU and hard drive, which slows the computer's processing speeds. It is therefore critical to consider the organization and end-user needs to provide sufficient memory.
  - *Peripherals* – Other components to evaluate include the amount of video card memory, the amount of memory available for the printer, the monitor size, and the speed of the CD-ROM drive.

All of these factors should be considered when determining the types of PCs needed within the agency, along with how long what is purchased will support the current needs of the agency.

Considering Agency Size

Larger agencies are expected to be able to support multiple PC configurations, allowing for the best fit between workers and their tasks. Small agencies without in-house IT departments may find that it is more cost effective to have only one or two different configurations to reduce the costs of the outside contractors that maintain the equipment. Larger agencies with dedicated IT support staff will find it easier and cheaper to do upgrades than smaller agencies that must contract for all technical support. Larger IT departments also are expected to have the resources to investigate and test alternative PC configurations with the appropriate metrics to determine the most cost-effective PCs for their needs. For very small agencies, however, especially those that rely upon contract help for their PC maintenance, the cost of replacing PCs might be less than the time and expense of researching and testing possible upgrades.

b. Upgrading versus Replacement

While an understanding of technology factors is important in selecting technology to acquire, it is also important for determining how to incorporate upgrades into a life cycle. Upgrading selected pieces of a PC, particularly memory, can be cheaper than purchasing and installing a new PC. However, in today's technology environment, it is unusual to make upgrades to the PC other than memory. Replacement cycles should be established and remaining PCs should be cascaded downward to less sophisticated users. Motherboard replacements used to be handled as upgrades but now, replacing the motherboard frequently results in the replacement of the CPU and other components as well. Plug and play components such as video and sound cards are also likely upgrades for PCs.

Industry trends indicated that from 1990 through 1997, new software requirements ushered in new PC hardware. Since the release of the Pentium III and IV machines, the hardware has generally been more than adequate to support the majority of software applications produced in recent years. As a result, PC hardware configurations are stabilizing and are less likely to change as a result of new software releases.[26]

The first step in determining whether to upgrade or replace is to know the internal agency staff or outsourced (contract) cost for support and upgrades. Determining the most effective strategy must include an understanding of the staff costs involved, as well as the hardware costs. The following questions are also important:

- Are employees able to get their work done with the existing equipment and software? If so, there is no need to upgrade or replace PCs at this time.
- Can the current equipment be upgraded economically?
- What support costs are associated with maintaining multiple agency configurations for hardware and application images?

For example, when a worker is having difficulty completing assignments because they have to wait while loading or switching between programs, then consider upgrading the current equipment with more memory or upgrading some other specific hardware that is limiting performance, such as the video card. Satisfactory performance can often be achieved inexpensively.

Consider upgrading when:

- More memory will solve end user problems. Memory is a very inexpensive upgrade that produces clear results.
- Some other hardware components are limiting performance, such as the video card.
- An increase in tasks, usage, or workers causes a bottleneck in network resources, so that networking equipment must be upgraded.
- A move to a standard organization configuration would increase user productivity while reducing agency support costs.

For example, if an end user's monitor doesn't support the resolution needed to take advantage of new features in the latest version of a computer-aided design (CAD) program, the monitor and/or the video card can be upgraded. The old monitor can be moved to a project that does not require such a high resolution.

Consider replacement when:

- Advances in PC operating systems or in other PC software allow for more useful or efficient ways of performing tasks, and current equipment cannot be adapted.

26 See footnote 7 (Margevicius).

- One-time events, such as the Y2K problem, require a remediation change in the hardware.

For example, when a PC operating system doesn't support a new software package that would provide needed services/value to the agency, it may be a case for replacement. In this case, it might be wise to upgrade only the operating system if the hardware can support it. Later, additional memory can be added as needed. However, there are times when the hardware must be upgraded to support new application software and operating systems.

In some cases, upgrading or replacing may be an option. In a situation where an operating system upgrade or an upgrade of other software requires more memory than the motherboard on an end user's PC can support, the PC would need a new motherboard. Upgrading the motherboard usually requires that a new CPU also be purchased. The type of memory used on the new machine might be incompatible with the previous configuration, so it would need to be replaced as well. The upgrade of a motherboard and CPU provides essentially the same performance results as a new PC, while avoiding the expense of purchasing computer parts that you already have, such as the case, modem, etc.

> The main reasons companies might lengthen the PC replacement cycle would be because of budget constraints, fewer demands for new applications, fewer revisions to product lines, or meeting needs by upgrading existing systems' memory and storage.
>
> — *Information Week* [27]

Due to the level of time and expertise required to juggle all the variables involved with such extensive changes, however, only those agencies with in-house expertise in the full range of PC equipment should perform such intricate upgrades. The overall expense may be too high to make this an effective upgrading option, so some agencies may also choose to replace the PC in this scenario.

> **Upgrading Pro**
>
> Upgrading older equipment with new cards or peripherals that are a couple of revisions older than the latest "killer" technology can be a very cost-effective way of boosting productivity and functionality. Many limitations can be resolved by upgrading a specific component of the current computer without resorting to buying a new machine.
>
> **Upgrading Con**
>
> Memory is the easiest and cheapest upgrade to make. Beyond that, upgrades may cost up to 70% to 80% of the system in time and equipment costs. Other upgrades may only extend the life of the PC for another 6 months or so.
>
> — *Government Computer News* [28]

27 Weston, Rusty. "Behind the Numbers: PC Purchasing made Simple." *Information Week*. March 8, 1999. Retrieved 17-Mar-2003 from <http://www.informationweek.com/bizint/biz724/24bzpur.htm>.

28 Walker, Richard W., "The Ins and Outs of Upgrading," *Government Computer News,* July 1999. Retrieved 17-Mar-2003 from <http://gcn.com/vol18_no22/shopper/procurement/284-1.html>.

A common management approach to replacement strategies is to standardize the agency on specific vendors and further, on specific makes and models. The single-source acquisition approach is designed to lower the costs for support and upgrading and provide the IT staff with greater control of the desktop computing environment. End users, including management, must be aware of this policy; however, understanding that policy is effective only if it is supported.

Some organizations that have standardized on particular models have found that end users will buy other models from the same vendor, or that the standard is simply not enforceable.[29] However, many agencies today are achieving success in standardizing organization configurations and benefiting from bulk purchasing power by unifying all purchases through the IT departments. This process of coordinating all technology purchases through the IT department is major success factor in cost effective computing management and further extends the PC life cycle. This is true because the technology is more likely to remain compatible with the organization infrastructure standards and directions.

DIR's white paper on leasing versus purchasing identifies the pros and cons of both acquisition methods.[30] It also provides the organization's decision makers with the benefits attributed to each procurement alternative.

Additionally, seat management alternatives for acquisition are viable when the configurations are standardized. These management licenses for PC replace and refresh strategies offer a new world of support choices to improve agency efficiencies and effectiveness.

The State of Texas negotiated contracts with numerous vendors and manufacturers in 2001 to provide the state with the best seat management alternatives possible for the widest range of PC and software configurations.[31] The concept of seat management has been discussed and supported by the Governor's Office and DIR since the spring of 2001. When seat management alternatives include desktop support, organizations can also benefit from reallocating the IT staff to support networks that are increasingly depended upon for agency communication and information access.

c. Deployment

- *Consider Cascading*

  Be aware of the difference between cascading and upgrading. Cascading PC equipment refers to the practice of moving older technology from power users to users with more limited needs. Upgrading can occur either with or without a corresponding cascading process. Cascading will save on the need to acquire new hardware, as PCs will be used throughout the organization for a lengthy period. Agencies using cascading policies often have large numbers of

29 Paul, Loren G., "Going Steady," *CIO,* July 15, 1999. Retrieved 17-Mar-2003 from <http://www.cio.com/archive/071599_single.html>.

30 See footnote 1 (State of Texas).

31 See footnote 17 (State of Texas).

employees, and the cost of continually investing in new hardware is considered prohibitive. With a cascading policy, however, technical support staff must then support all the types of desktop and laptop computers in use. If operating systems are not standardized, this can add significantly to the support costs for lower-end equipment.[32]

Cascading can be a valid and cost-effective management strategy, but the decision of whether or not to cascade equipment must be incorporated into the life cycle establishment process. Cascading can be used to help manage end-user needs—as a power user group requires new machines, their machines can be turned over to staff with less intensive processing requirements. The cascading must be monitored to ensure that all staff has adequate computing resources to do their work. Cascading will also result in the leveling of the PC hardware budget across the biennium since replacement and cascading can enable one-third of the PCs to be replaced per fiscal year.

- *Agency-wide Deployment*

  It is important to remember that an organization of any size will need to determine what percentage of the agency will receive the PCs acquired. Will all users receive new equipment at one time or will the new PCs be distributed to a portion of the user-base and older equipment cascaded or salvaged. How often will high-end users versus low-end users receive new/refreshed equipment? How often will new software operating systems be installed requiring user training? What level of help desk support is required to resolve breakage versus user questions on hardware and software usage? These are all considerations to be investigated while determining how the PCs will be deployed to the agency staff. As previously discussed, the answers to these questions will help determine the best acquisition strategy as well as the best deployment alternative.

C. Incorporate Technology into the Life Cycle

Considering all of these technology factors is necessary when determining an agency's PC life cycle; however, technology does not drive the life cycle decision, it is factored into the life cycle.

- Look at the type of technology that should be acquired—where is it in the product life cycle and why is that stage appropriate?
- Look at what is most important for the agency—is it stability, performance, or value?
- Determine the quality and capacity of the component parts (CPU, hard drive, floppy drive, bus speed, video, RAM, modem speed, and monitor size).

As an example of how to incorporate technology into the agency PC life cycle, the State of Montana has adopted a 4-year life cycle replacement schedule. The schedule defines a minimum level PC as one that performs adequately when running three to four of the following standard state applications simultaneously: e-mail, Web browser, word

32 Enderle, Rob, "Cascading PC Strategies: An Overview and Recommendation," Giga Information Group, August 20, 1999.

processor, spreadsheet, desktop database, Oracle, and/or PeopleSoft. Montana's PC life cycle policy includes a chart is that maps the introduction of new technology to the established life cycle.[33]

33 See footnote 6 (State of Montana) or Appendix F.

Establishing the Life Cycle

The results of the steps of the decision process provide the necessary information for establishing an effective life cycle:

1. The IRM has management support for the life cycle creation process and has selected specific criteria that will be most important in the decision process.
2. Agency processes are in place to manage PCs; end-user needs are identified and mapped to the available technology. IR staffing skills, availability, and priorities are also factored in. Agency technology purchasing is coordinated through the IT departments across the organization for standardization and future compatibility.
3. The state of current technology has been assessed; the priorities of the agency for the type of technology needed are identified.
4. Deployment issues have been considered.

Once these elements are in place and the agency has determined the importance of all relevant factors, it can make a decision based on the information collected. The basis for tracking the success of the life cycle decision is also in place, as the criteria have been developed and can now be tracked once the life cycle management process is in place to see if the expected benefits are in fact being realized.

The life cycle determination is a synthesis of the information gathered in the previous steps, where the factors are evaluated and a decision is made about how long the technology can be supported and the most effective way to support it, and how long the users can use the selected hardware package. Each determination will be unique, as the agency decides priorities and weighs the cost effectiveness of alternative options. At this point it should be clear, however, that the industry standard life cycle cannot simply be adopted by an agency without going through this determination process to ensure that it is relevant to the needs and constraints of the agency.

State of the State

The following initiatives may be of interest to agencies seeking to establish life cycles.

- TEX. GOV'T CODE ANN. § 2175.128 (Vernon 2002) directs agencies to donate unsold surplus and salvage data processing equipment to the Texas Department of Criminal Justice (TDCJ). TDCJ may repair and resell this equipment through inmate education programs. Equipment will be repaired or upgraded, or usable parts will be salvaged for later reuse. The refurbished equipment will be transferred or sold to school districts, political subdivisions, or state agencies.
- The Statewide Property Accounting (SPA) division of the Comptroller of Public Accounts established a task force that revised the Uniform Statewide Accounting System codes for data processing equipment. The task force issued recommended depreciation schedules for defined codes in June of 2001.[34] Agencies seeking to establish desktop and laptop life cycles should coordinate with their property managers to remain up to date with SPA activities. Conversely, **the IRM should notify the property manager when a life cycle has been established** so that the SPA records for the agency calculate the depreciation based on agency life cycles instead of default SPA standards.

Applying the Life Cycle

Leasing

The life cycle process and the acquisition process must be considered simultaneously, as they can affect one another. Leasing is increasingly being discussed as an option for state agencies.[35] An agency must adhere to the industry life cycle if the agency is leasing its PCs, as the terms of a lease will be less favorable if an alternate life cycle is adopted. Acquisition decisions must be made when determining a life cycle because the acquisition method will add distinct costs and/or benefits, depending on how well the acquisition dovetails with the life cycle adopted. A longer life cycle may be shortened to the industry standard if the benefits of leasing, for example, outweigh the possible added expense of replacing technology more quickly than users need.

Seat Management

Texas began evaluating seat management contracts for desktop and laptop replacement and maintenance (including customer support alternatives and software selections) and negotiated pre-established equipment and support rates with a wide variety of vendors in the 2001–2002 biennium. These seat management alternatives can be found in DIR's online Product and Services Catalog.[36] DIR provides contract support for agencies trying to utilize these seat management contracts to ensure the best solution possible.

34 State of Texas, "State Property Accounting User Manual," Comptroller of Public Accounts, May 2002. Available online at *SPA Chapter 4: Class Code Directory,* Web page, accessed 28-Mar-2003 at <http://www.window.state.tx.us/comptrol/san/fm_manuals/spa_man/spa_user2000/spauser_ch4.html>.

35 See footnote 1 (State of Texas).

36 See footnote 17 (State of Texas).

Phased-in Life Cycles

When establishing PC life cycles, developing a phased approach to life cycle implementation can help to standardize PC hardware budgets. If an agency has determined that a 3-year life cycle is appropriate (either as an agency as a whole, or for a particular subset of users), one-third of those PCs can be scheduled for replacement each year. The aggregate of PCs purchased for each year should become stable as the life cycle program is phased in.

Case Study

To illustrate how the entire process might actually work in practice, consider the following case.

Robert is a recently appointed IRM in a medium-sized public services-oriented agency that has about 300 employees, 75% of whom are involved in delivering direct services to the public. The remaining 25% are either program, administrative support, or are management personnel. The agency's periodic IT budgeting process has just begun, and as one of Robert's first tasks as IRM, he has been asked by the agency director to estimate the agency's PC-related needs for the upcoming biennium. As the IRM, he has been given the managerial authority to address the organization's PC life cycle issues, and to establish policy for the agency related to PC life cycles.

Robert thought that an easy way to get started would be to review the agency's most recent biennial operating plan and simply calculate from previous operating budgets how much the PC hardware and software line items have increased each year. He would then use this percentage increase factor to estimate PC costs for the upcoming year. In other words, he would simply use historical cost factors as his guide to future estimates.

Before proceeding, however, Robert decided to follow the steps outlined in this paper. What follows are highlights of his process, what he learned about his agency's use of PC technology, and what he decided to do about PC life cycles in his agency as a result.

Step 1: Gain management support for taking a life cycle approach to desktop technology

Robert set up meetings with several key people who make decisions about PC technology purchases in his agency. He met first with the agency's financial officer to get additional details about what the agency's annual PC expenses are. This included a review of equipment, software, *and* training expenses, in addition to the Help Desk's overall costs. Next, he met with the Help Desk manager and the LAN administrator to understand how they view desktop support tasks and whether or not they track time allocated to PC-related services. He also met with the agency's program directors to understand how they allocate and track PC costs to specially funded projects. From these interviews and conversations, Robert learned the following:

- The PC budgeting process in the agency is rather ad hoc. PCs are not a planned and consistent expense item. Instead, purchases are usually based on end-of-year financing and occasional budget requests to the Legislature.
- PC costs in the agency have escalated over the past 3 to 4 years and the agency's financial officer is concerned about this.

- The agency doesn't have an official policy for upgrading and/or replacing PCs. Decisions about what to do with PCs that are no longer useful, for whatever reason, are made at the program and departmental level. No agency-wide policy or procedure is in place.

- The agency's PC costs have risen as the FTE count has gone up. Almost every employee in Robert's agency (except for mailroom and delivery personnel) uses a computer. Additionally, employees who work in the field and those who telecommute use laptops provided by the agency. During the current year, because of a federal legislative mandate, Robert's agency adds 50 employees. If Robert had calculated his projection for the upcoming biennium based only the increases in spending from previous years, he would have vastly underestimated the PC-related increases generated as a result of adding the new employees.

After Robert reviewed these factors and trends in his agency, he met with the agency director to lay out plans for standardizing PC life cycles in the agency. They decided the basis for evaluation of the project would be defined in terms of technical staff time savings, meaning that Robert's employees would spend less time on routine maintenance and support of PCs, freeing them to work on more critical projects.

Step 2: Evaluate agency end-user needs

Robert's research made it apparent that different groups in his agency have different needs for desktop computing technology. With this in mind, he decided to conduct a brief survey of a representative group of employees in the agency in order to determine how they use technology. From the survey results, Robert learned the following:

- *Computer Use* – There were differences in the ways that people in different types of jobs used their computers and in the types of software tools they needed. For example, managers in the agency use their PCs primarily for presentations, word processing, and e-mail, whereas program delivery personnel also use their PCs to access and update files and generate reports from the agency's case file databases.

- *Technical Support* – The technical services groups (LAN services and Help Desk staff) spent 300 hours supporting the agency per week. Support included assistance with installations and upgrades, troubleshooting (both in person and over the phone on various types of hardware, software, and network problems), and repairs. This averaged out to at least an hour of technical support per employee each week. A closer examination of the statistics showed personnel with certain older PC models experienced greater technical difficulties; the individuals with this equipment were identified as primary candidates for new PCs.

- *Training* – Most employees had never received formal training on the software packages they were asked to use every day. Many employees reported that they did not know about or use certain functions that might help them do their work faster. Across the board, employees reported that they could benefit from periodic training sessions on new software products and product upgrades.

Step 3: Evaluate technology factors

Robert realized that because PC purchases were made on an ad hoc basis, no detailed, agency-wide inventory of PC technology existed. To address this, he developed a survey that supervisors could fill out to list the kinds of hardware and software technology that actually existed in their divisions, departments, or work units. Once the survey was completed and deployment alternatives were considered, Robert learned the following:

- The agency had PCs ranging from brand new to 5 years old. PCs were replaced on an ad hoc basis as divisions had excess funds. Administrative staff and new employees were often given older machines.
- Software upgrades were also made on an ad hoc basis, so most machines were not running the same versions of various software programs.
- There was a storeroom filled with PCs and monitors that were not being used. Since the agency had no PC disposal policy, no action had been taken on the obsolete equipment.
- There are adequate FTE resources to install the new technology as well as cascading the older PCs that still have residual value for the low-end users. Standardization of the agency PC configuration reduced the total desktop support costs enabling the agency information technology projects to be activated by the same personnel resources previously required to support multiple configurations.

Establish life cycle(s) appropriate for the agency based on steps 1, 2, and 3

Robert synthesized all of the information he'd gathered through his interviews and surveys to help him establish life cycles. He knew that he wanted to reduce staff support time, so he focused on how to control those costs, especially through reducing the numbers and types of equipment that were in use at the agency. The 75% of staff involved with service delivery needed basic office suite software and Internet/e-mail connectivity for communication with clients and service providers. Some administrative personnel had similar requirements, so they were also included in that user category. Other administrative staff included technology support staff and executive management. The technology staff had intensive computing needs, while executive management required an up-to-date laptop for presentations.

Robert realized the end users with similar usage requirements needed to have a consistent PC platform. Stability and value were his primary considerations, as very few users had a need for the latest technology.

Robert then developed the following life cycles:

- The majority of the staff would be able to function appropriately under a 4-year life cycle. Past that point in time, the effort to support the hardware would increase, and the cost of upgrading software suites would need to be factored in.
- Technology support staff were assigned a 3-year life cycle for their PC needs, as their equipment was used heavily and the latest technology was needed to track problems, support applications and hardware, and assist users.

- Executive management laptops were given a 2.5-year life cycle. The life cycle was extended slightly as several managers noted compatibility problems with presentation equipment at other locations. Very advanced laptops were often not compatible with the projectors available for presentations.

Robert also made the following acquisition decisions:

- In order to have a consistent PC hardware budget, Robert planned to phase in the life cycles. With the 4-year life cycle, he planned to replace one-fourth of the PCs each year, beginning with the new fiscal year. The first PCs to be replaced would be the oldest ones and those identified as problem computers, in order to bring employees up to par with their coworkers and ensure that all staff had access to the resources appropriate for their needs. Limited cascading of equipment was allowed in the new life cycle, so that machines could be cycled through various users, as long as the 4-year life cycle was followed.
- Because the majority of agency staff would be operating on a 4-year life cycle, Robert chose not to lease PCs, based on the information in DIR's white paper on leasing versus purchasing.[37] Thus, there will still be disposal costs, but operational costs will be minimized through controlling PC acquisition more effectively.

After all of Robert's plans were implemented, he established a methodology to track the benefits realized from using a standard life cycle policy. Because fewer versions of hardware and associated software were now in use at the agency, Robert saw hardware support costs fall as staff spent less time troubleshooting hardware problems. Once the problem PCs, which were priorities on the replacement list, were replaced by new equipment, support time was further reduced. Standardizing the types of equipment obtained also meant that support of the PCs became less of a burden, as the range of knowledge required for support decreased. Robert was able to free 50 staff hours per week from hardware support, enabling his staff to work on mission-critical technology projects.

From the employees' side, standards were developed according to job requirements, so employees received a desktop and/or laptop computer based on identified job needs, promoting the effective use of technology in conducting daily activities.

37 See footnote 1 (State of Texas).

Appendix A:
Criteria for Assessing Benefits

Agencies can use the following criteria to help them assess the benefits of establishing a PC life cycle. The criteria are based on an understanding of how an agency uses technology, and how that use is measured. Agencies can pick items that are most relevant to their specific needs, but are not limited to the criteria in this list.

Cost Savings

- Amount of money spent on PC hardware and software equipment annually (breaking out the cost of replacement and upgrade parts)
- Consolidation of purchases to leverage volume discounts
- Cost of replacement equipment and/or equipment maintenance
- Reduction in technology purchases outside the organizations master plan due to the ability to align the business needs and computing needs to the agency strategic directions

Savings in Support Staff Time

Support staff time savings should be quantified at all levels, from staff involved at procurement levels to support staff.

- Time spent on the IT procurement process by staff (including financial and property management staff who perform the paperwork, and equipment disposal costs)
- Time spent by support staff on PC maintenance/troubleshooting (measured overall, by end user group or by equipment type)
- Number and types of platforms supported, and the varying staff expertise required to deal with multiple versions of hardware and software
- Average annual savings (measured per PC, per user, or per support staff time)
- Inventory savings

Increased Productivity for End Users

Platforms should be mapped to user needs, ensuring that users have the necessary tools to perform their job. Sample areas of productivity are:

- PC maintenance calls per user and average time spent per call
- Time to deliver needed technology to a user's PC
- Reduced downtime

Appendix B:
Assessment of Management Roles

Assessing the role of management is an essential step in establishing an efficient and effective PC life cycle. Management, including executive management, division management, and IT management, needs to have a clear understanding as to their level of authority and support, current standards, current policies and procedures, and future expectations. The following series of questions is intended to help clarify the roles of management in the PC life cycle process.

Authority and Support

Purchasing

- Is the purchasing process for PCs centralized or decentralized?
- Does the IRM have approval authority over all IT purchases? If not, why not?
- What kind of communication do purchasers have with the IRM?

Management

- Do managers adequately relay/justify employee's needs/purchases to the IRM?
- Does the IRM consult with executive management on technology needs and approvals?
- Is there clear executive support for the establishment of a PC life cycle under the authority of the IRM?
- Will an established life cycle policy be effectively adhered to? If not, why not?

Technology

- How much time does the technical staff spend on support? How much time is spent on repairing, upgrading, and replacing PCs?
- Do Help Desk records show patterns of problems with certain makes or models of equipment?
- Do all end user groups require the same amount of support, or are there areas that experience more difficulties? If so, is it possible to reduce support needs by upgrading or replacing equipment?

Standards

- Are there set standards for IT acquisition?
- Who has the authority to set standards? (If it is not the IRM, why not?)
- Who decides the priorities for IT spending?

Current Policies and Procedures

What are the agency's policies and procedures for:

- PC technology acquisition?
- PC upgrading?
- PC replacement?
- PC repairs?
- PC disposal?
- Tracking PC costs across divisions?

Future Expectations

- What are the expected benefits from having a life cycle in place?
- Does the agency plan for an increase (or decrease) in the number of computers based on an increase (or decrease) in agency employees?

Appendix C:

Assessment of Equipment Inventory

Assessing the agency's inventory of PC equipment is another essential step in establishing an efficient and effective PC life cycle. Conducting an inventory of the current PC equipment would yield information regarding what types and versions are being used, as well as determining the range of ages. The following is a series of questions designed to get an overview of the current desktop and laptop computer equipment.

All Agencies

All agencies IT managers should know answers to the following questions:

- How many total desktop computers are in the agency?
- How many total laptop computers are in the agency?
- If you have multiple locations, how many desktop computers are at each location?
- How many laptop computers are at each location?
- What type and how many different vendors/brands are in use? (IBM, HP, Gateway, Dell, DEC, Mac (Apple), Toshiba)
- What type and how many processors are in use? (Pentium, Celeron, Duron, XP)
- What type and how many operating systems are in use? (Windows XP, Win2000, MacOS8, Linux)

To determine the general age of the PC inventory, enter the approximate number of PCs in each age category for both desktop and laptop computers. Knowing the approximate age of your PC inventory helps to identify your assets, determine your current PC usage, and identify where changes could be made.

Desktop Computers		Laptop Computers	
0–2 years	______	0–12 months	______
2–3 years	______	12–18 months	______
3–4 years	______	18–24 months	______
4–5 years	______	24–36 months	______
5+ years	______	36+ months	______

An important example of how the age of a PC plays a role in the replacement cycle is notable when you consider that most PCs (desktop or laptop computers) purchased in 1999 cannot run the current versions of the Microsoft operating systems. Many agencies have already upgraded their PC hardware as a result of this. Additionally, for many agencies, the PCs were either replaced or upgraded as a part of the Year 2000 preparation and conversion efforts in Texas. This means that many computers will have been purchased recently enough to support the extended life cycles this paper recommends, possibly up to 5 years.

More Complex Agencies

For agencies with more complexity, such as multiple locations or very large size, it would be helpful to answer the following questions:

- What are the low-end and high-end amounts of memory in the desktop computer inventory?
- What are the low-end and high-end amounts of memory in the laptop computer inventory?
- What are the low-end and high-ends amounts of hard disk space?
- How much equipment is in storage?
- How many different storage locations are there?
- How many software suites are in use?
- How many software versions are being supported?
- How many different application versions are being supported?
- Is there any "new" or "upcoming" agency function/system expected to be supported or to operate on the desktop/laptop environment? If so, what PC configurations are needed?
- What general software applications are installed on the organization's PCs and laptops? What is the minimum amount of storage and processing speed required to support the software applications?

Summary

Agencies should use their equipment inventory assessments to develop standard configurations for end-user profiles. Smaller agencies may conclude that a single profile and configuration is sufficient to meet their organization's needs. Larger agencies generally deploy several standard profiles and configurations to meet the needs of the high-level (multi-functional) user, the mid-level user, and low-end user.

1. Identify the PC environment standard configurations:
    - Define the standard configuration for the desktop (high, medium, low).
    - Define the standard configuration for the laptop (high, medium, low). Be sure to specify software to transport data to the network or desktop from the laptop.

2. Identify the training required to support the desktop and laptop environments:
   - IT technical training.
   - Software application support training (including mail and communication applications, word processing, operating system, system application software training).
   - Network access for PCs and network support.
   - Stand-alone applications and support resources.
   - End-user application training.

Appendix D:

Assessment of End Users' Needs

The matrix provided can help agencies determine their end users' needs. End users should be categorized according to their functionality group. The individual function groups should be based on similar computing needs.

1. List the agency's functionality groups with their corresponding job duties. List as many as needed to show minimum or maximum needs. Different functionality groups may use different degrees of technology (low-end to high-end).
2. Document the number of FTEs allocated to each functionality group.
3. List the applications each functionality group uses.
4. List the computer resources (hardware) each functionality group needs.
5. List the year(s) that the equipment was purchased, and/or list the CPU type(s) in use.

   Note: The CPU type may provide a better indication of computing power than age. CPUs may have been replaced in older equipment.
6. List the expected replacement date(s).

The completed matrix is an inventory of the computer resources and applications used per functionality group. It should help to assess whether the current technology is appropriate for the needs of the user group. While end-user needs may vary significantly implying a need for different life cycles, it is important not to consider PC replacements as isolated events, rather as a part of a master organizational master plan. Establishing established user profiles for computing, the support costs can be reduced for a variety of hardware and software. This is critical during a time when IT staff will be asked to do more with less due to budgetary constraints.

A sample matrix and a blank matrix are provided on the following pages.

PC Life Cycle Assessment Matrix — Sample

Group	Job Duties	FTEs	Applications Used	Computer Resources	PC Details				Replace	
					Cycle	Qty	Yr	Type	Qty	Yr
Admin. Assistants	Clerical	12	Office software (word processing, spreadsheet, database), e-mail, Internet	Standard agency PC configuration, 17" monitor, 20G HD, 128M memory, CD, 32M Video	5.0-yr	4 4 4	FY02 FY03 FY05	Cel 1.0G P4 1.5G P4 1.6G Dur 1.0G XP 1500+ XP 1600+	4 4 4	FY07 FY08 FY09
Client Services	Work with customers to solve problems	100	Office software (word processing, spreadsheet, database), e-mail, Internet, Client Tracking System	Standard-plus agency PC configuration, 17" monitor, 40G HD, 128M memory, CD, CDRW, 32M Video.	4.5-yr	20 40 40	FY01 FY02 FY01	P4 1.5 P4 1.6G P4 1.7G XP 1600+ XP 1600+ XP 1700+	100% 50% 50% 100%	FY06 FY07 FY06
Executive	Management	3	Office software (spread-sheet, word processing, database, project man-agement, presentation soft-ware), e-mail, Inter-net, Visio	Mid-range agency PC configuration, 19" monitor, 60G HD, 256M memory, CDDRW, DVD, 64M Video	4.0-yr	3 3	FY00 FY00	P4 1.6G P4 1.7G P4 1.9G XP 1600+ XP 1700+ XP 1800+	3 3	FY05 FY05
Publishing	Document preparation (multiple formats)	3	Office software (word processing, spreadsheet, presentations); e-mail, In-ternet, page layout, Web publishing software	Advanced mid-range agency PC configuration, 21" monitor, 80G HD, 512M memory, CDDRW, DVD, 128M Video	4.0-yr	2 1	FY00 FY00	P4 1.8G P4 1.9G P4 2.0G P4 2.2G XP 1900+ XP 2000+	2 -0-	FY05 —

PC Life Cycle Assessment Matrix

Group	Job Duties	FTEs	Applications Used	Computer Resources	PC Details				Replace	
					Cycle	Qty	Yr	Type	Qty	Yr

Appendix E:

Shorter vs. Longer Desktop Cycles

The following article on how to compare costs of exercising different desktop or computer life cycles is only an example that uses the 3-year cycle versus the 4-year cycle to exhibit the savings that could be expected. This article is not intended to suggest DIR's support of a 3-year life cycle. It is provided solely as an example since the cost justification and associated discussion may be helpful to IRMs in conducting their agency needs studies.

Web & Collaboration Strategies

META Group

Date: 16 November 2001
File: 1061
Author: Kurt Schlegel

Radical Desktop Changes Can Assuage IT Budgets.
After virtual stagnation for the past 2 years, desktop architecture and support processes will be dramatically redesigned to cut costs and improve efficiencies. The biggest improvements will come from choosing the right "delivery channel" for each application.

META Trend: During 2001/02, client standardization and managed build/distribution processes will enable an adaptive and cost-effective end-user computing environment, with more focus on standardized certification than on technology homogeneity. Through 2003, IT staff will face challenges managing numerous pervasive client devices and personal computing lifestyles. By 2005, client-computing models centered on IT group device ownership will yield to managed subscription services across corporate and personal devices.

Desktop total cost of ownership and standardization were "hot topics" in 1997/98, and most Global 2000 organizations finalized their desktop architecture standards and accompanying support processes in time for Y2K preparations. Since that time (2Q99), however, there has been little change in how end users access their applications. During the past 4 months, we have noticed a complete reversal of this desktop dormancy trend—organizations are planning to make radical changes at the desktop to cut costs and support users more efficiently. Yet some companies are planning desktop cost savings through shortsighted strategies (e.g., extension of the PC life cycles, widespread thin-client replacements). In tough economic times, management's first instinct is to cut discretionary spending and focus only on the "core" operations to keep the business running. These knee-jerk reactions can often backfire.

Similar to an entrepreneur needing to spend money to make money, we believe IT organizations should in-vest, through discretionary spending, in a fundamental redesign of the desktop that will yield a more cost-effective end-user computing environment. The primary strategy in the desktop redesign is to leverage recent trends to create an end-user portal framework that personalizes the interface for an end user, aggregating all the applications and information sources an end user will need. By 2002, desktop architecture groups will be working with Web services teams to ensure application "delivery channels" are coordinated with the portal rollout. By 2004/05, desktop architecture groups will have formally defined application delivery channels that are closely linked to the portal framework. Just as businesses determine the cost of various "customer" channels (e.g., direct sales, reseller/partner, telesales) and push certain products through a specific channel to a determined customer constituency, so will IT organizations determine which applications they will deliver through a particular channel.

There are five possible application delivery channels:

- Server-based/thin client (e.g., Citrix)
- Browser-based
- Fat-client packaged (e.g., applications have been tested and put into a format where a software distribution tool could be delivered)
- Build/image-based (e.g., ghosting)
- Outsourced via an application service provider

Business Impact
CIOs are demanding IT budget cuts. Rash decisions that constrict desktop flexibility will impinge on end-user productivity, and business will ultimately suffer.

Organizations must first determine which products (i.e., applications) the IT group will "sell." This is a difficult exercise, because many companies have hundreds or thousands of applications they are responsible to support. Most companies will reduce that number significantly, but business units will cling to some legacy applications. In the name of CIO-mandated cost savings, some companies now require that certain legacy applications be accessible only through the most inexpensive delivery channels. Next, organizations must determine the delivery channel(s) available for every application. Most organizations currently deliver applications as packaged fat-client applications. Our research indicates a trend toward more applications not only being delivered as thin client or browser-based, but also being deployed within the image or client build (i.e., burned on the image). Finally, organizations must determine user constituencies (e.g., knowledge worker, mobile professional, task-based worker, developer/engineer) to guide application deployment channel selection. This process is similar to channel selection for traditional CRM customer segmentations (e.g., "Time Over Money," "Golden Age").

Cost-savings rules can be broken down into three categories:

- Procurement and asset management cost-saving rules:

  Set up a charge back policy that "funds" IT efforts by business unit and brings accountability to the business units for the IT products they consume. Structure the charge back system so that it provides a range of economic choices that are familiar to most consumers.

  Avoid lengthening PC life cycles past 3 years. Organizations are easily tempted to improve cash flow by reducing hardware expenses, but we see this as a quick-fix solution that will eventually lead to higher costs and lower productivity than for the typical 3-year notebook/3-year desktop life cycle (see Figures 1 and 2 in Addendum). This rule does not apply to task-based workers, however.

- Identification, certification, and selection cost-savings rules:

  Do not confuse standardization with homogeneity. The IT organization's role is to test and certify an application to ensure that it will not cause problems in the field. These services should be funded by the requesting business unit(s).

  Strike a balance between the IT group's mission to support business-unit requirements (offering choice and flexibility) and its mission to standardize and reduce costs. Where possible, find synergies across business units (e.g., convince departments to use similar applications).

- Support and deployment cost-savings rules:

  Support the build. Instead of diagnosing the source of a problem, reformat the hard disk and load a new system image. A problem with this approach is that the user's system is typically down for about an hour before the machine is fully restored, but this is mostly unattended downtime (i.e., no IT staff needed). In addition, any unsupported applications, customized settings, or client-side data will be lost, making it crucial that this effect be clearly communicated to end users. Within 3- to 5-years, IT organizations will be able to preserve PC personality (see WCS 956, 30 Oct 2000).

  Organizations that perform hardware break-fix work should seek warranty reimbursement from the manufacturer. IBM and Compaq have programs where IT employees can be certified for warranty repairs.

Bottom Line
Enlightened investments for radical restructuring of desktop architecture to make it congruent with a portal framework, as well as to delineate clear application delivery channels, will prove more beneficial than short-term tactics to simply cut costs.

Figure 1 — 3-Year vs. 4-Year Desktop Refresh Cycle

3-Year Desktop w/ Monitor	Time Est.	$/Hour	Cost	Life Cycle	Depreciated Cost
PC Procurement Administration	1.88	$65	$122.20	3	$40.73
PC Purchase	NA	NA	$1,100.00	3	$367.33
PC Install	0.56	$65	$36.40	3	$12.13
PC Upgrade Labor	0	$65	$0.00	3	$0.00
PC Upgrade HW	NA	NA	NA	3	NA
PC HW Break-Fix Labor (e.g., failures)	0.56	$65	$36.40	3	$12.13
PC HW Break-Fix Replacement Parts	NA	NA	$150.00	3	$50.00
PC Software Support (e.g., drivers)	1.5	$65	$97.50	3	$32.50
PC Disposal	0.5	$65	$32.50	3	$10.83
Annual Hard Cost per PC					**$525.65**
Lost end-user productivity (soft costs)	12.5	$65	$812.50	1	$812.50
Total Soft and Hard Costs					**$1,338.15**

Assumptions for a 5,000-user organization with a ***3-year*** PC hardware refresh cycle:

1. **PC Procurement Administration:** Procurement administrators assist in the overall sourcing and procurement workflow within the PC/LAN environment. Responsibilities include catalog and buy list management, execution of purchase orders, price quoting, authorizations, shipping/receiving, and asset tracking. The typical ratio for procurement administration is about 1 FTE for every 1,000 users. With 5,000 users and a 3-year life cycle, 1,600 PCs are purchased per year through 5 FTEs of a procurement administrator. With 1,800 working hours per year, it would take 5.63 hours per PC to fill 5 FTEs' time at this ratio, but not all their time is devoted to PC hardware acquisition. Assume it is only 33%, with the rest devoted to software, peripherals and other miscellaneous. Thus, 1.88 hours (i.e., one-third of 5.63 hours) are allocated per PC purchase.
2. **PC Purchase:** Assume a desktop PC has a street price of $750, plus $250 for a 17-inch monitor, plus $40 in shipping, plus 6% tax, equals $1,100.
3. **PC Install:** Assume it takes 60 minutes to install a new PC, including all associated application and end-user data settings and initial training for the end user on the new system (e.g., review of controls and settings). If the technician does 3 in parallel, then 1 FTE can do 24 machines in 1 day (i.e., 3 per hour for 8 hours). However, a nightmare scenario occurs in 3% of the situations, requiring another day to install successfully with no parallelism. This will take an extra 14 minutes per machine (8 x 60 x 0.03). So, on average, it takes 20 minutes (1 hour divided by 3, to account for parallel work) plus 14 minutes (to account for nightmare scenarios) for a total of 34 minutes per machine (i.e., 0.56 hours per machine).
4. **PC Upgrade Labor:** Assumes that desktops with a 3-year life cycle are not upgraded.
5. **PC Upgrade HW:** Assumes that desktops with a 3-year life cycle are not upgraded.
6. **PC HW Break-Fix Labor:** Assumes a 75% chance of a major hardware failure (e.g., disk, memory, CPU, monitor) occurs in the life of the machine. The labor to replace the part, test the system, and record the event in an asset management log is approximately 45 minutes: 45 min. x 75% = 34 min. (0.56 hours),
7. **PC HW Break-Fix Replacement Parts:** Assumes a 75% chance of a major failure (e.g., disk, memory, CPU, monitor) occurs in the life of the machine. The average price of the replacement part (e.g., disk, memory, CPU) is $200: $200 x 0.75 = $150.

8. **PC Software Support:** This cost bucket does not account for all software support or application rollout costs—it accounts just for system-level software support issues (e.g., driver compatibility). We assume 3 incidents will occur during the life of this machine regarding lack of driver support. Assuming each incident takes 30 minutes to resolve, total support time is 1.5 hours (i.e., 3 incidents x 30 minutes).
9. **PC Disposal:** Assume it takes 30 minutes to visit a PC, scrub the hard drive, box the equipment, and send it to a loading dock for shipment.
10. **Lost End-User Productivity:** Assumes that all end-user downtime is due to break-fix issues, operating system and application crashes, and staring at an hour glass. We assume 0.56 hours for PC HW break-fix issues, 1.5 hours for software support, and 1 crash every 3 days, requiring 5 minutes to reboot: 5 min. x (220 working days per year/3days per crash) = 365 min., or 365/60 = 6 hours of downtime, plus 5 minutes of hour glass time per day everyday x 220 working days per year = 1,100 minutes per year; 1,100/60 = 18 hours of downtime annually. Total Lost End-User Productivity = 0.56 hours/3 years for PC HW Break-Fix issues, 1.5 hours/3 years for software support, and 6 hours for crashes, plus 18 hours of hour glass time = 25 hours per year. We assume the average fully burdened worker costs $65 per hour. We also assume that users are not completely unproductive during downtime (i.e., able to do non-computer related tasks). So, discounting 25 hours by 50% (25 x 0.50) = 12.5 hours.

4-Year Desktop w/ Monitor	Time Est.	$/Hour	Cost	Life Cycle	Depreciated Cost
PC Procurement Administration	2.38	$65	$154.70	4	$38.68
PC Purchase	NA	NA	$1,100.00	4	$275.00
PC Install	0.56	$65	$36.40	4	$9.10
PC Upgrade Labor	0.375	$65	$24.38	4	$6.09
PC Upgrade HW	0	$0	$150.00	4	$37.50
PC HW Break-Fix Labor (e.g., failures)	0.66	$65	$42.90	4	$10.73
PC HW Break-Fix Replacement Parts	NA	NA	$180.00	4	$45.00
PC Software Support (e.g., drivers)	3.33	$65	$216.45	4	$54.11
PC Disposal	0.5	$65	$32.50	4	$8.13
Annual Hard Cost per PC					**$484.34**
Lost End-User Productivity (soft costs)	18.5	$65	$1,202.50	1	$1,202.50
Total Soft and Hard Costs					**$1,686.84**

Assumptions for a 5,000-user organization with a ***4-year*** PC hardware refresh cycle.

1. **PC Procurement Administration:** Procurement administrators assist in the overall sourcing and procurement workflow within the PC/LAN environment. Responsibilities include catalog and buy list management, execution of purchase orders, price quoting, authorizations, shipping/receiving, and asset tracking. The typical ratio for procurement administration is about 1 FTE for every 1,000 users. With 5,000 users and a 4-year life cycle, 1,250 PCs are purchased per year through 5 FTEs of a procurement administrator. With 1,800 working hours per year, it would take 7.14 hours per PC to fill 5 FTEs' time at this ratio, but not all their time is devoted to PC hardware acquisition. Assume it is only 33% with the rest devoted to software, peripherals, and other miscellaneous. Thus, 2.38 hours (i.e., one-third of 7.14 hours) are allocated per PC purchase.
2. **PC Purchase:** Assume a desktop PC has a street price of $750, plus $250 for a 17-inch monitor, plus $40 in shipping, plus 6% tax equals $1,100.

(continued)

Figure 1 — 3-Year vs. 4-Year Desktop Refresh Cycle, continued

3. **PC Install:** Assume it takes 60 minutes to install a new PC, including all associated application and end-user data settings and initial training for the end user on the new system (e.g., review of controls and settings). If the technician does 3 in parallel, then 1 FTE can do 24 machines in 1 day (i.e., 3 per hour for 8 hours). However, a nightmare scenario occurs in 3% of the situations, requiring another day to install successfully with no parallelism. This will take an extra 14 minutes per machine (8 x 60 x 0.03). So, on average, it takes 20 minutes (1 hour divided by 3, to account for parallel work) plus 14 minutes (to account for nightmare scenarios) for a total of 34 minutes per machine (i.e., 0.56 hours per machine).
4. **PC Upgrade Labor:** Assumes a 75% chance that a PC with a 4-year life cycle will be upgraded during its life cycle. It typically takes 30 minutes or 0.5 hours to perform the upgrade: 0.75 x 0.5 = 0.375 hours
5. **PC Upgrade HW:** Assumes a 75% chance that a PC with a 4-year life cycle will be upgraded at a $200 hardware cost during its life cycle: $200 x 0.75 = $150
6. **PC HW Break-Fix Labor:** Assumes a 90% chance of a major hardware failure (e.g., disk, memory, CPU, monitor) occurs in the life of the machine. The labor of to replace the part, test the system, and record the event in an asset management log. 45 minutes x 90% is 40 minutes or 0.66 hours.
7. **PC HW Break-Fix Replacement Parts:** Assumes a 90% chance of a major failure (e.g., disk, memory, CPU, monitor) occurs in the life of the machine. The average price of the replacement part (e.g., disk, memory, CPU) is $200: $200 x 0.90 = $180.
8. **PC Software Support:** This cost bucket does not account for all software support or application rollout costs—it accounts just for system-level software support issues (e.g., driver compatibility). We assume 5 incidents will occur during the life of this machine regarding lack of driver support. Assuming each incident takes 40 minutes to resolve, total support time is 3.33 hours (i.e., 5 incidents x 40 min. = 200 min. divided by 60).
9. **PC Disposal:** Assume it takes 30 minutes to visit a PC, scrub the hard drive, box the equipment, and send it to a loading dock for shipment.
10. **Lost End-User Productivity:** Assumes that all end-user downtime is due to break-fix issues, operating system and application crashes, and staring at an hour glass. We assume 0.66 hours for PC HW break-fix issues, 3.33 hours for software support, and 1 crash every 2.5 days (blended average of 4 years), requiring 5 minutes to reboot: 5 min. x (220 working days per year/2.5 days per crash) = 440 minutes, or 440/60 = 7.33 hours of downtime, plus 7 minutes of hour glass time per day (blended average over 4 years) everyday x 220 working days per year = 1,540 minutes per year; 1,540/60 = 25.67 hours of downtime annually. Total Lost End-User Productivity = 0.66 hours for PC HW break-fix issues, 3.33 hours for software support, and 7.33 hours for crashes, plus 25.67 hours of hour glass time = 37 hours per year. We assume the average fully burdened worker costs $65 per hour. We also assume that users are not completely unproductive during downtime (i.e., able to do non-computer related tasks). So, discounting 37 hours by 50% (37 x 0.50) equals 18.5 hours.

Source: Meta Group

Appendix F: Five-Year PC Replacement Cycle Considerations

The following information was extracted from the State of Montana's "PC Replacement Cycle" policy, which is available online at <http://www.discoveringmontana.com/itsd/policy/policies/entpcs010.asp>.

This appendix serves as an example of potential expenses related to PC life cycle policies. Any dollar estimates in this appendix are for descriptive purposes only and do not reflect actual state expenditures.

Summary

Extending the PC replacement cycle from the current 4-year cycle to 5 years has both financial and technical considerations.

Changing to a 5-year cycle has the potential to save the state $945,000 in PC purchase costs per fiscal year, but additional maintenance costs to keep those PCs in service the fifth year would certainly reduce that savings, and could even eliminate the savings or cost more than a 4-year replacement cycle. Extending the replacement cycle shifts cost from highly visible hardware expenditures to less visible support costs, especially personnel services. From a Total Cost of Ownership (TCO) perspective, we believe the net benefits of the proposed change are likely to be minimal, at best. Note also that the cost of lost user productivity and diminished service associated with work disruptions is not quantified.

The workload placed on PCs by applications is just now beginning to change significantly, making this an appropriate time to thoroughly research and position "thin client" devices as an alternative to traditional PCs. Where there is an appropriate workload, replacing traditional PCs with "thin client" devices has the potential for significant savings (greater than 50%) compared to replacement with a traditional PC.

We suggest that all new development be required to employ a "three-tier" architecture to assure the ability to use "thin client" devices in the future.

Financial Considerations

The following table provides cost comparisons between a 4-year and 5-year PC replacement cycle.

		4-Year Cycle	5-Year Cycle	Savings
Number of PCs to replace	10,500	2,625	2,100	
Cost of PC replacement [1]	$1,800	$4,725,000	$3,780,000	
Potential additional costs				
Add'l warranty [2]	$100		$210,000	
Add'l operating system upgrade [3]	$291		$611,100	
Add'l parts & labor cost [4]	$150		$315,000	
Total		$4,725,000	$4,916,100	

Notes

1 PC replacement costs are based solely on the currently installed base, not on previous or proposed budget amounts.

2 Standard warranty is 3 years. An additional year of warranty may be necessary in the 5-year cycle to mitigate hardware failure risk. An alternative might be to adopt a hardware sparing policy.

3 Microsoft discontinues support for an operating system 4 years after initial release. Our experience has shown that operating systems work well through 3 years, begin to have problems in the 4th year (stability, driver availability, etc), and are in serious need of replacement by the 5th year. Cost of upgrade includes $141 software license and $150 (3 hours) labor.

4 Estimate $150 per PC for equipment upgrades and/or labor to keep PC in service for 5th year. Common options include upgrading memory ($50-$100), swapping PCs from high-end to low-end users (3-4 hours, $150-$200), and misc. parts replacement (cost varies).

It is important to note that these additional costs are “worst case” and would not necessarily be incurred for every PC. Additional warranty costs could probably be reduced by assuming more risk and adopting alternative fix/replace and sparing strategies. Operating system upgrades could be done only on PCs exhibiting problems or when applications require it. The additional parts and labor line item is the only one which has little potential for reduction because PCs kept in service for an extra year are going to need more attention to keep them running adequately.

It is also important to note that costs associated with user disruption and reduced productivity have not been factored into the above cost table. Users will have more service outages as PCs age and have problems. Older PCs will run applications more slowly. These will have an impact on productivity, but we are not aware of any specific studies to measure this cost.

Technical Considerations

Industry Best Practice Guidelines

Gartner recommends the following PC replacement cycles:

- 4 years for low-end/mainstream users
- 3 years for high-end users
- 3 years for laptop users

Gartner also recommends refreshing the client operating system as hardware is refreshed.

Operating System Viability

Microsoft operating system (OS) life cycles typically follow a 4-year cycle from introduction to discontinuance of Microsoft support. While the OS will continue to function after this time, risk is introduced in a number of areas: inability to get vendor support to resolve problems, availability of hardware drivers (e.g. printers), and inability to support new releases of application software (with the likely result being application enhancements and implementations being slowed by the PC inventory).

A 5-year replacement cycle implies that 20% of the state's PC would be without OS support from the manufacturer unless the OS is upgraded. The 5-year cycle will also place greater burden on ITSD and agency staff to be expert in and support additional OS versions.

Hardware Reliability

Hardware reliability has improved steadily over the years. Manufacturer service has become a distinguishing feature of successful vendors as PCs have become a commodity. Our current term contract vendors offer a standard 3-year warranty and an optional 4-year warranty, but *do not offer a 5-year warranty.* Many agencies purchase the standard 3-year warranty and fix or replace the PC if it breaks after that. Changing to a 5-year replacement cycle would cause re-evaluation of warranty, break/fix and sparing strategies.

Changing Software Demands on PC Hardware

PC-centric software, such as the office suite and client-based applications, place heavy demands on desktop processing capacity and require substantial desktop PCs. The state currently has a heavy reliance on these types of applications since the majority of many agencies' applications use this desktop-intensive approach.

However, most new application development places the processing burden on an application server and uses a web browser interface or a "thin-client" architecture (i.e. Citrix MetaFrame), which requires far less desktop processing power. Some applications such as SABHRS and POINTS have already moved to a "thin-client" architecture, and a review of agency strategic plans indicates that many agencies are planning to replace old client-based applications with new browser and "thin-client" applications. Unfortunately, there are many applications that need to be replaced and therefore it will take considerable time to do this on a statewide basis (several biennia). Therefore, while some near-term PC cost savings can be achieved on selected desktops, the majority of desktops will continue to require a substantial PC during the next biennium.

In the future, high-end PCs will be needed on far fewer desktops (e.g. application developers, engineers, financial analysts, etc) and mainstream users will be able to get by with substantially less local processing power.

Application designs that employ "thin clients" are known as "three-tier" architectures (database server, application server, and client tiers). Without specific intent to design applications with this model, the use of traditional, "fat client" PCs will continue and costs unnecessarily increased. "Three-tier" application architecture should be the stated standard for multi-user applications.

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